McCORMICK TURBINES

S. MORGAN SMITH CO.
YORK, PA.

Bulletin 110

McCORMICK TURBINES

MANUFACTURED BY

S. MORGAN SMITH CO.

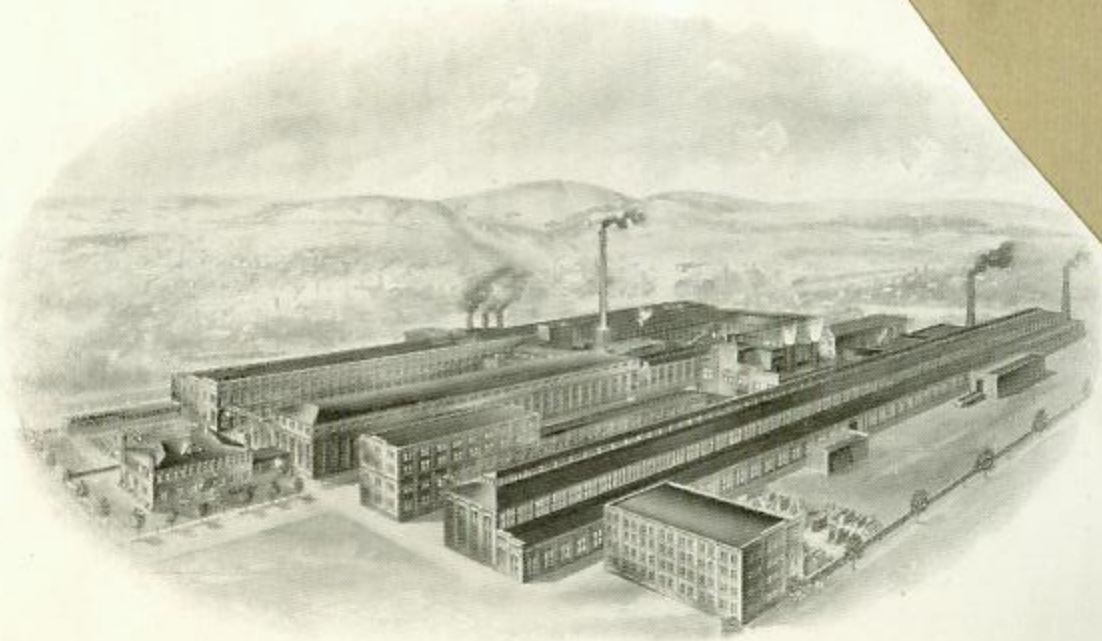
YORK, PA., U. S. A.

BRANCH OFFICES

BOSTON	CHICAGO	MONTREAL
176 Federal St.	76 West Monroe St.	405 Power Bldg.

Cable Address
"Success"

Codes: ABC 4th and 5th Edition
Lieber's
Western Union
Bentley's



THE WORLD'S LARGEST HYDRAULIC TURBINE WORKS

S. MORGAN SMITH COMPANY, YORK, PA.

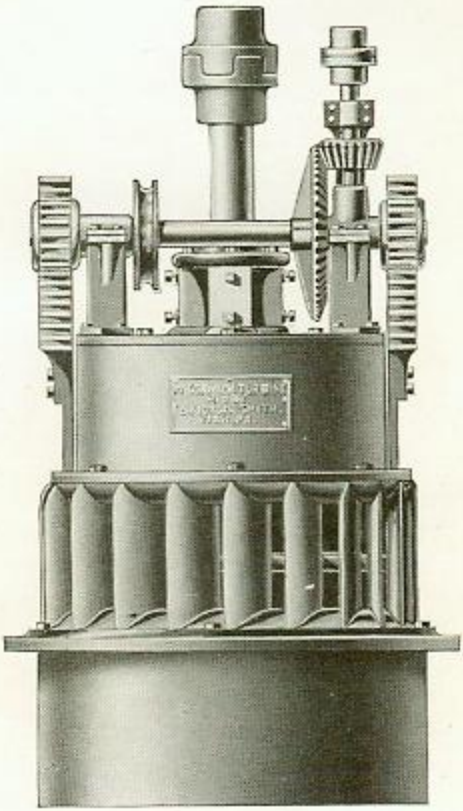
Introductory.

OUR purpose in publishing this Bulletin is to be able to present to our many customers, who are using the well known McCormick cylinder gate turbine, a set of tables giving the power, speed and water consumption of same, and also to meet the requirements where we quote on small turbines of this type to prospective customers who prefer a cylinder gate wheel.

This Bulletin does not represent the complete line of turbines built by this Company, as we continue to build the New Success turbine and also the Smith turbine. We have, also, designed and built many other types of turbines, some of which develop much greater capacity and higher speed than either the McCormick, New Success or Smith turbines.

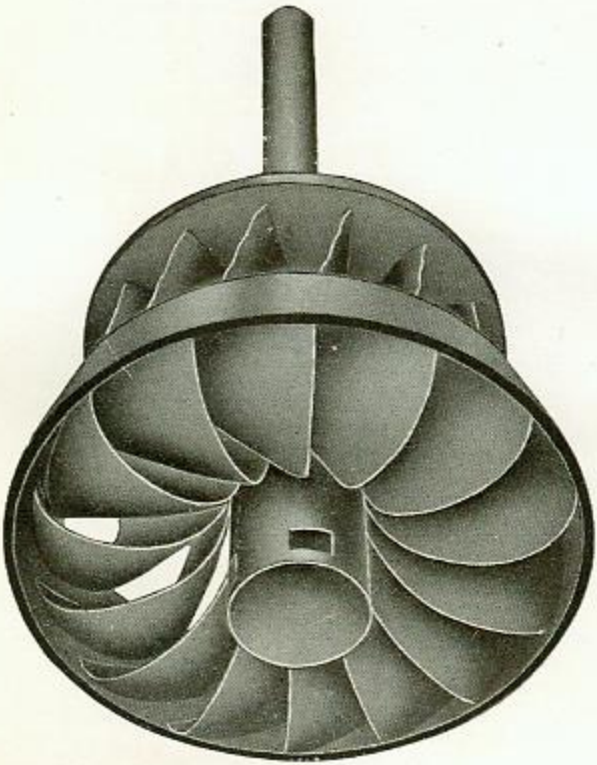
Those contemplating the purchase of turbine water wheels and accessories will find it to their interest to communicate with this Company as our designing and estimating departments are at all times at the service of our prospective customers.

S. MORGAN SMITH COMPANY,
YORK, PA.



Engraving No. 401.

Represents the standard vertical McCormick Turbine. All wheels 24" and smaller will be shipped complete as shown. Larger sizes will be shipped in sections for convenience in handling.



Engraving No. 402.

Represents the standard McCormick runner with its shaft and cast iron step shoe. These standard runners are made of cast iron. Attention is called to the openings for water for cooling the concave surface of the step shoe that turns on the lignum vitae step.

Directions for the Construction of Head and Tail Races

THE HEAD RACE

In constructing the canal or head race, a very frequent error is committed by failing to give it sufficient capacity. It should be wide and deep, and especially where the race is of considerable length, and a large quantity of water is to pass through it. As a general rule, the water should not flow faster than from 60 to 120 feet per minute. Where there is a long race, after the turbine has been running three or four hours the head frequently draws down from one to three feet. The effect of this is the same as if the dam had been lowered an equal distance—resulting in a loss of power, which would have been prevented by making the race as wide and deep as it should be.

When the water is to be conveyed through pipes to the turbines operating under low heads, the receiving ends of the pipes should be well submerged so as prevent any possibility of their drawing air. The diameter of the pipe to be recommended varies according to the quantity of water, length and contour of the pipe, head of water acting on the turbine and the head loss permissible due to friction.

THE TAIL RACE

This should be wide and deep, and the level of the bottom of the wheel pit should be carried from ten to forty feet below the end of flume, depending upon the amount of water discharged by the turbine, and if possible it should be carried out to the bed of the stream, as no tail race for even small turbines should have less than two feet of dead water in it before the turbines are put in motion, and where large turbines (using considerable water) are to be used, the tail race should have three or four feet of dead water in its entire length. By having the tail race thus constructed, as soon as the water is discharged from the turbines, it will push out or displace the dead water in the race, thus preventing a loss of head. For instance, to be more explicit, suppose the bottom of tail race is on a level with the water in main stream into which the tail

race discharges, when the turbines are started the water in tail race would rise in proportion to the width of the race and the quantity of water flowing therein, and reduce the working head in proportion; while if the race were as first above stated, the water from the turbines would displace the dead water without rising above the water in the main stream, thus utilizing the full amount of head. From one to three feet of working head is often lost for want of proper depth and width of tail race.

WHEEL PIT

Here is where mill owners and millwrights, in putting in turbines are more liable to err than elsewhere. Whether under high or low heads, the pit should be deep and wide. There is no case where this is more important than where a large turbine is run under a low head; as under these circumstances it is not desirable to lose any head whatever. A pit of insufficient size causes the water to react upon the turbine, and an additional loss of power is also caused by the fact that a portion of the head is consumed in forcing the water out of the pit when there is not sufficient outlet. As a rule, the depth of the pit should not be less than the diameter of the lower end of the draft tube.

Water has but 100 per cent. in it, and a turbine that takes out from 80 to 90 of that per cent. leaves but little force in it. To expect that the water coming through our turbines will have power to wash the sand and gravel out of their own pit, is to expect what will not be realized. Hence in putting in turbines, do not calculate upon the water in the wheel pit to do any work. If you find it foaming and dashing in the pit, then rest assured that the pit is either too shallow or too narrow, or both.

SETTING TURBINES ABOVE TAIL WATER

Sometimes in adapting turbines to high and even low heads, it becomes necessary to set the turbines some distance above the tail water and conduct the water from them through draft tubes. Better results may be obtained when turbines are set in this manner than if placed close to the tail water, provided the draft tubes are air tight and their discharge ends properly submerged. In all cases when draft tubes are used, they should be made of steel or concrete.

Directions for Setting Wheels

In setting turbines of our manufacture in a wooden penstock, the first thing to do is to see that the floor of the flume is level. Generally a ring made of soft wood is placed on the floor around the hole, on which the draft tube flange of the wheel, which is faced off, is set. It is very important that the flume be built on good foundations so as not to settle when the water is let in; a very good plan, and especially where large turbines are to be set, is to put four posts or iron columns under the timbers around the hole in the floor through which the draft tube passes.

The step and all bearings of the turbines are carefully adjusted before leaving the shops.

When turbines are shipped "knocked down," the draft tube should always be set in position first, then the runner or wheel proper placed on the step, then set the case and so on until all parts are together. When the step is properly adjusted, there will be a space between the top of the band of the runner and the bottom or inner edge of the bottom plate of 1/32". When the turbines are not to be run for some time, the step shoes should be well covered with tallow to prevent rusting.

WARRANTY

Turbines installed in accordance with our instructions and operated at speeds recommended by us, for each installation, failing to give the power guaranteed by us, can be returned if not broken, to the station to which they were shipped any time within thirty days, and the money received for such wheels will be refunded. If purchaser finds it impossible to put the turbine in and give it a trial within the thirty days allotted, and wants more time it will be granted on application, not exceeding in all sixty days from date of shipment.

S. MORGAN SMITH COMPANY.

Test and Tables of Turbines

The tables of the turbines of our manufacture are based on actual tests made in the Holyoke Testing Flume—*the only reliable testing flume in the country*. Both right and left hand turbines have been tested and brought to over 80 per cent. efficiency. Although our tables are only based on 80 per cent. useful effect from the water used, all of the turbines have exceeded 80 per cent. in the tests, *some sizes having given over 90 per cent. at less than full gate with very high average from half to full gate.*

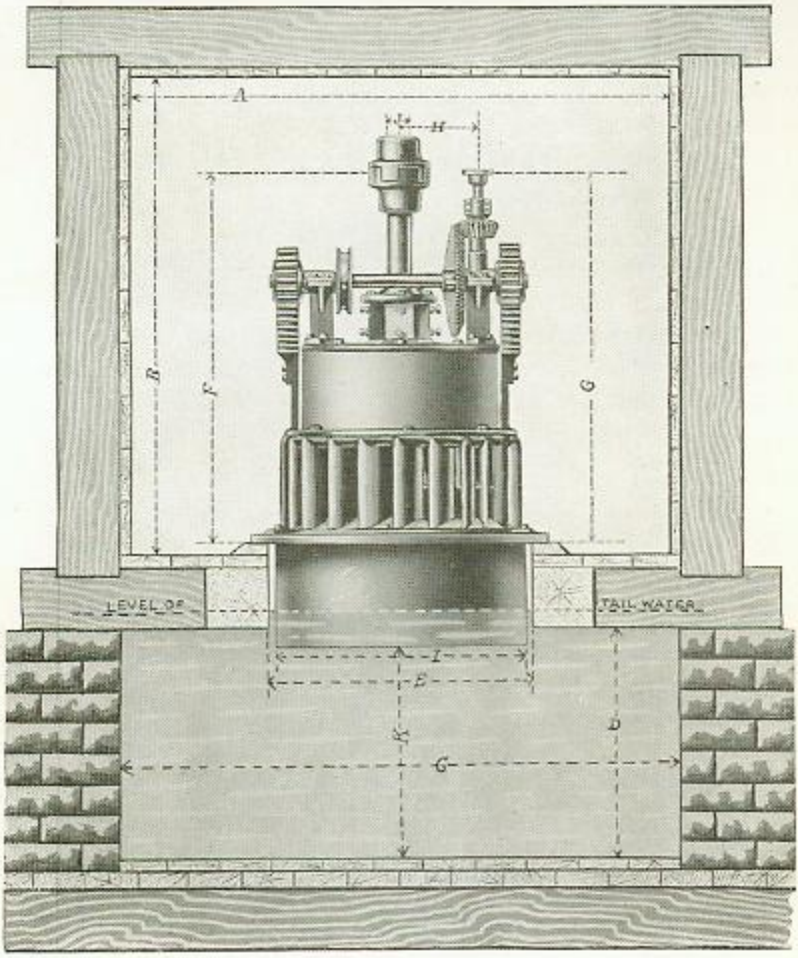
When comparing the tables of our turbines with those of other manufacturers, satisfy yourself that the tables of those turbines are reliably made. Many turbine builders have tabled their turbines at 80 or even 90 per cent., when if the truth were known, their turbines in actual test would not exceed 60 to 70 per cent.

Before purchasing a turbine be assured that the tables of the particular size turbine you require are based on actual tests made in the new flume of the Holyoke Water Power Company. Water powers are becoming more valuable each year, and the owners of water powers cannot afford to run turbines which sacrifice water and give but little power.

The following rule will enable you to determine the percentage at which any turbine is tabled.

RULE

Multiply the cubic feet of water by 62½, which is the weight of one cubic foot of water; multiply the product by the head, which will give the foot pounds; divide that product by 33,000, which gives the full horse-power of the water; divide the horse-power claimed by the full horse-power of the water, and the result will be the percentage at which the turbine is tabled.



Engraving No. 403.

Shows Turbine in wooden flume. See dimensions on page 11.

DIMENSIONS of TURBINES and PENSTOCKS IN INCHES

Lettered columns correspond with letters in engraving on page 10

Diameter of Wheel	A	B	C	D	E	F	I	J	K
9	36	33	33	24	16	22	14¾	1⅜	18
12	42	48	45	28	20	35	18¾	2⅛	22
15	48	54	60	34	25	41	23⅛	2⅜	28
18	54	58	69	40	28	44	26⅜	2⅞	34
21	63	66	78	45	33	50	30¾	3⅛	39
24	72	69	87	51	37	55	34⅞	3⅜	45
27	84	72	96	56	42	57	39½	3⅜	50
30	90	78	108	62	46	63	43⅜	3⅝	56
33	102	90	120	66	51	73	48¼	4⅛	60
36	108	96	132	72	54	78	52	4⅜	63
39	120	102	144	78	59	82	56⅝	5⅛	69
42	126	105	156	81	64	85	61⅜	5⅜	72
45	138	108	168	84	68	90	65⅛	5⅜	75
48	144	114	180	90	72	96	69¼	6⅜	81
51	153	126	192	99	76	105	73¾	6⅞	87
54	162	135	204	105	81	111	78	7⅜	93
57	168	138	216	111	85	114	82⅛	7⅜	99
60	180	144	228	117	89	118	85⅝	7⅜	105
66	192	150	240	123	96	121	90¾	7⅜	111
72	204	156	252	129	101	123	96⅜	7⅜	117

9-INCH WHEEL

Head.	Revolutions per Minute.	Discharge. Cubic feet per Minute.	Horse Power.
5	297	204	1.5
6	325	223	2.0
7	351	241	2.6
8	375	258	3.1
9	398	273	3.7
10	420	288	4.4
11	440	302	5.0
12	460	316	5.7
13	479	329	6.5
14	497	341	7.2
15	514	353	8.0
16	531	365	8.8
17	547	376	9.7
18	563	387	10.5
19	579	397	11.4
20	594	408	12.3
21	608	418	13.3
22	623	428	14.2
23	637	437	15.2
24	650	447	16.2
25	664	456	17.2
26	677	465	18.3
27	690	474	19.3
28	702	482	20.4
29	715	491	21.5
30	727	499	22.6
31	739	508	23.8
32	751	516	24.9
33	763	524	26.1
34	774	532	27.3
35	785	539	28.5
36	796	547	29.8
37	807	554	31.0
38	818	562	32.3
39	829	569	33.5
40	840	577	34.8

9-INCH WHEEL

Head.	Revolutions per Minute.	Discharge. Cubic Feet Per Minute.	Horse Power.
41	850	584	36.2
42	860	591	37.5
43	870	598	38.8
44	881	605	40.2
45	891	612	41.6
46	900	618	43.0
47	910	625	44.4
48	920	632	45.8
49	929	638	47.2
50	939	645	48.7
52	957	657	51.7
54	976	670	54.7
56	993	682	57.7
58	1011	694	60.8
60	1028	706	64.0
62	1045	718	67.2
64	1062	729	70.5
66	1078	741	73.9
68	1095	752	77.2
70	1111	763	80.7
72	1126	773	84.2
74	1142	784	87.7
76	1157	795	91 3
78	1172	805	94.9
80	1187	815	98.6
85	1224	840	107.9
90	1259	865	117.6
95	1294	888	127.5
100	1327	912	137.7

12-INCH WHEEL

Head.	Revolutions per Minute.	Discharge. Cubic feet per Minute.	Horse Power.
5	223	355	2.7
6	244	389	3.5
7	263	420	4.4
8	282	449	5.4
9	299	476	6.5
10	315	502	7.6
11	330	527	8.8
12	345	550	10.0
13	359	573	11.2
14	373	594	12.6
15	386	615	13.9
16	398	635	15.4
17	411	655	16.8
18	422	674	18.3
19	434	692	19.9
20	445	710	21.5
21	456	728	23.1
22	467	745	24.8
23	477	762	26.5
24	488	778	28.2
25	498	794	30.0
26	508	810	31.8
27	517	825	33.7
28	527	840	35.6
29	536	855	37.5
30	545	870	39.4
31	554	884	41.4
32	563	898	43.4
33	572	912	45.5
34	581	926	47.6
35	589	940	49.7
36	597	953	51.8
37	606	966	54.0
38	614	979	56.2
39	622	992	58.4
40	630	1004	60.7

12-INCH WHEEL

Head	Revolutions per Minute.	Discharge. Cubic Feet per Minute.	Horse Power.
41	638	1017	63.0
42	645	1029	65.3
43	653	1041	67.7
44	660	1053	70.0
45	668	1065	72.4
46	675	1077	74.9
47	683	1089	77.3
48	690	1100	79.8
49	697	1112	82.3
50	704	1123	84.8
52	718	1145	90 0
54	732	1167	95.2
56	745	1188	100.6
58	758	1210	106.0
60	771	1230	111.5
62	784	1251	117.2
64	796	1271	122.9
66	809	12,0	128.7
68	821	1310	134.6
70	833	1329	140.5
72	845	1348	146.6
74	856	1366	152.8
76	868	1385	159.0
78	879	1403	165.3
80	891	1420	171.7
85	918	1464	188.1
90	945	1507	204.9
95	970	1548	222.2
100	996	1588	240.0

15-INCH WHEEL

Head.	Revolutions per Minute.	Discharge. Cubic feet per Minute.	Horse Power.
5	178	566	4.3
6	195	620	5.6
7	211	670	7.1
8	225	716	8.7
9	239	760	10.3
10	252	801	12.1
11	264	840	14.0
12	276	877	15.9
13	287	913	17.9
14	298	947	20.0
15	308	981	22.2
16	319	1013	24.5
17	328	1044	26.8
18	338	1074	29.2
19	347	1104	31.7
20	356	1132	34.2
21	365	1160	36.8
22	374	1188	39.5
23	382	1214	42.2
24	390	1240	45.0
25	398	1266	47.8
26	406	1291	50.7
27	414	1316	53.7
28	421	1340	56.7
29	429	1364	59.8
30	436	1387	62.9
31	443	1410	66.0
32	451	1432	69.3
33	458	1455	72.5
34	464	1476	75.9
35	471	1498	79.2
36	478	1519	82.6
37	484	1540	86.1
38	491	1561	89.6
39	497	1581	93.2
40	504	1601	96.8

15-INCH WHEEL

Head.	Revolutions per Minute.	Discharge. Cubic feet per Minute.	Horse Power.
41	510	1621	100.4
42	516	1641	104.1
43	522	1660	107.9
44	528	1680	111.7
45	534	1698	115.5
46	540	1716	119.4
47	546	1734	123.3
48	552	1754	127.2
49	558	1772	131.2
50	563	1808	135.3
52	574	1826	143.5
54	585	1842	151.8
56	596	1894	160.3
58	607	1910	169.0
60	617	1961	177.8
62	627	1994	186.8
64	637	2026	195.9
66	647	2057	205.2
68	657	2088	214.6
70	666	2119	224.1
72	676	2149	233.8
74	685	2178	243.6
76	694	2207	253.5
78	703	2236	263.6
80	712	2265	273.8
85	734	2335	299.8
90	756	2402	326.7
95	776	2468	354.3
100	796	2532	382.6

24-INCH WHEEL

Head.	Revolutions per Minute.	Discharge. Cubic feet per Minute.	Horse Power.
5	113	1547	11.7
6	124	1695	15.4
7	134	1831	19.4
8	143	1957	23.7
9	152	2076	28.2
10	160	2188	33.1
11	168	2295	38.1
12	175	2397	43.5
13	182	2495	49.0
14	189	2589	54.8
15	196	2680	60.7
16	202	2768	66.9
17	208	2853	73.3
18	214	2936	79.8
19	220	3016	86.6
20	226	3095	93.5
21	232	3171	100.6
22	237	3246	107.9
23	242	3318	115.3
24	248	3390	122.9
25	253	3460	130.7
26	258	3528	138.6
27	263	3595	146.7
28	267	3661	154.9
29	272	3726	163.3
30	277	3790	171.8
31	281	3853	180.5
32	286	3914	189.3
33	290	3975	198.2
34	295	4035	207.3
35	299	4094	216.5
36	303	4152	225.8
37	307	4209	235.3
38	312	4265	244.9
39	316	4321	254.7
40	320	4376	264.5

27-INCH WHEEL

Head.	Revolutions per Minute.	Discharge. Cubic feet per Minute.	Horse Power.
5	106	1960	14.8
6	116	2147	19.5
7	125	2319	24.5
8	134	2479	30.0
9	142	2629	35.8
10	149	2771	41.9
11	157	2906	48.3
12	164	3036	55.0
13	170	3160	62.1
14	177	3279	69.4
15	183	3394	76.9
16	189	3505	84.7
17	195	3613	92.8
18	200	3718	101.1
19	206	3820	109.7
20	211	3919	118.4
21	217	4016	127.4
22	222	4110	136.6
23	227	4203	146.1
24	231	4293	155.7
25	236	4382	165.5
26	241	4468	175.6
27	245	4554	185.8
28	250	4637	196.2
29	254	4719	206.8
30	259	4800	217.6
31	263	4879	228.6
32	267	4957	239.7
33	271	5034	251.0
34	275	5110	262.5
35	280	5184	274.2
36	283	5258	286.0
37	287	5331	298.0
38	291	5402	310.2
39	295	5473	322.5
40	299	5542	335.0

30-INCH WHEEL

Head.	Revolutions per Minute.	Discharge. Cubic feet per Minute.	Horse Power.
5	93	2361	17.8
6	102	2586	23.4
7	110	2793	29.5
8	118	2986	36.1
9	125	3167	43.1
10	132	3338	50.4
11	138	3501	58.2
12	144	3657	66.3
13	150	3806	74.8
14	156	3950	83.6
15	161	4089	92.7
16	167	4223	102.1
17	172	4353	111.8
18	177	4479	121.8
19	182	4602	132.1
20	186	4721	142.7
21	191	4838	153.5
22	195	4952	164.6
23	200	5063	176.0
24	204	5172	187.6
25	208	5278	199.4
26	212	5383	211.5
27	216	5486	223.8
28	220	5586	236.3
29	224	5685	249.1
30	228	5782	262.1
31	232	5878	275.3
32	236	5972	288.8
33	239	6064	302.4
34	243	6156	316.3
35	246	6246	330.3
36	250	6334	344.6
37	253	6421	359.0
38	257	6508	373.7
39	260	6593	388.5
40	263	6677	403.6

33-INCH WHEEL

Head.	Revolutions per Minute.	Discharge. Cubic feet per Minute.	Horse Power.
5	81	2888	21.7
6	89	3163	28.7
7	96	3417	36.1
8	102	3653	44.2
9	109	3875	52.6
10	114	4084	61.7
11	120	4284	71.1
12	125	4474	81.1
13	131	4657	91.5
14	135	4833	102.1
15	140	5002	113.4
16	145	5166	124.9
17	149	5326	136.8
18	154	5480	149.0
19	158	5630	161.7
20	162	5777	174.5
21	166	5919	187.8
22	170	6058	201.4
23	174	6195	215.2
24	177	6328	229.4
25	181	6458	243 9
26	185	6586	258 7
27	188	6712	273 7
28	192	6835	288.1
29	195	6956	304.8
30	198	7075	320 7
31	202	7191	336 9
32	205	7307	353.3
33	208	7420	370.0
34	211	7531	386 9
35	214	7641	404.1
36	217	7750	421.6
37	220	7857	439.3
38	223	7962	457 2
39	226	8066	475.4
40	229	8169	493 7

36-INCH WHEEL

Head.	Revolutions per Minute.	Discharge. Cubic feet per Minute.	Horse Power.
5	79	3316	25.1
6	87	3632	32.9
7	94	3923	41.5
8	100	4194	50.7
9	106	4449	60.5
10	112	4689	70 9
11	118	4918	81.7
12	123	5137	93.1
13	128	5347	105.0
14	133	5548	117.4
15	137	5743	130.2
16	142	5931	143.4
17	146	6114	157.1
18	150	6291	171.1
19	154	6464	185.6
20	158	6632	200.4
21	162	6795	215.6
22	166	6955	231.2
23	170	7112	247.2
24	174	7265	263.4
25	177	7414	280.1
26	181	7561	297.1
27	184	7705	314.4
28	187	7847	332.0
29	191	7985	349.9
30	194	8122	368.2
31	197	8256	386.7
32	200	8388	405.6
33	204	8518	424.8
34	207	8646	444.2
35	210	8773	464.0
36	213	8897	484.0
37	216	9020	504.3
38	218	9141	524.9
39	221	9260	545.7
40	224	9378	566.9

39-INCH WHEEL

Head.	Revolutions per Minute.	Discharge Cubic feet per Minute.	Horse Power.
5	69	3898	29.4
6	76	4270	38.7
7	82	4612	48.8
8	87	4930	59.6
9	93	5229	71.1
10	98	5512	83.3
11	103	5781	96.1
12	107	6038	109.5
13	111	6285	123.5
14	116	6522	138 0
15	120	6751	153.0
16	124	6972	168.6
17	127	7187	184.6
18	131	7395	201.1
19	135	7598	218.1
20	138	7795	235 6
21	142	7988	253.5
22	145	8176	271.8
23	148	8359	290 5
24	151	8539	309.7
25	155	8715	329.2
26	158	8888	349.2
27	161	9057	369.5
28	164	9223	390.2
29	166	9387	411.3
30	169	9547	432.8
31	172	9705	454.6
32	175	9860	476.8
33	178	10013	499.3
34	180	10164	522.2
35	183	10312	545.4
36	186	10459	568.9
37	188	10603	592.8
38	191	10745	617.0
39	193	10885	641.5
40	196	11024	666.3

45-INCH WHEEL

Head.	Revolutions per Minute.	Discharge. Cubic feet per Minute.	Horse Power.
5	61	5096	38.5
6	67	5582	50.6
7	72	6030	63.8
8	77	6446	77.9
9	82	6837	93.0
10	87	7207	108.9
11	91	7558	125.6
12	95	7894	143.1
13	99	8217	161.4
14	102	8527	180.4
15	106	8826	200.1
16	109	9116	220.4
17	113	9396	241.4
18	116	9669	263.0
19	119	9934	285.2
20	122	10192	308.0
21	125	10443	331.4
22	128	10689	355.3
23	131	10929	379.8
24	134	11164	404.9
25	137	11395	430.5
26	139	11620	456.5
27	142	11842	483.1
28	145	12059	510.2
29	147	12272	537.8
30	150	12482	565.8
31	152	12689	594.4
32	155	12892	623.4
33	157	13091	652.8
34	160	13288	682.7
35	162	13482	713.0
36	164	13674	743.8
37	166	13862	775.2
38	169	14048	806.7
39	171	14232	838.7
40	173	14413	871.2

48-INCH WHEEL

Head.	Revolutions per Minute.	Discharge. Cubic feet per Minute.	Horse Power.
5	55	5749	43·4
6	60	6298	57·1
7	65	6802	72·0
8	70	7272	87·9
9	74	7713	104·9
10	78	8130	122·9
11	82	8527	141·7
12	85	8906	161·5
13	89	9270	182·1
14	92	9620	203·5
15	95	9958	225·7
16	98	10284	248·6
17	101	10601	272·4
18	104	10908	296·7
19	107	11207	321·8
20	110	11498	347·5
21	113	11782	373·9
22	115	12059	400·9
23	118	12330	428·5
24	121	12595	456·8
25	123	12855	485·6
26	126	13110	515·0
27	128	13360	545·0
28	130	13605	575·6
29	133	13845	606·7
30	135	14082	638·4
31	137	14315	670·6
32	139	14544	703·3
33	141	14769	736·5
34	144	14992	770·2
35	146	15210	804·1
36	148	15426	839·2
37	150	15639	874·4
38	152	15849	910·0
39	154	16056	946·2
40	156	16261	982·8

51-INCH WHEEL

Head.	Revolutions per Minute.	Discharge. Cubic feet per Minute.	Horse Power.
5	56	6545	49·5
6	61	7170	65.0
7	66	7745	81.9
8	70	8279	100.1
9	75	8782	119.4
10	79	9257	139 9
11	82	9708	161.4
12	86	10140	183 9
13	90	10554	207.3
14	93	10952	231.7
15	96	11337	257.0
16	99	11709	283.1
17	103	12069	310.0
18	106	12419	337.8
19	108	12759	366.3
20	111	13091	395.6
21	114	13414	425.7
22	117	13730	456.4
23	119	14038	487 9
24	122	14340	520.0
25	124	14636	552 9
26	127	14926	586.4
27	129	15210	620.5
28	132	15489	655.3
29	134	15763	690.8
30	136	16033	726.8
31	138	16298	763.4
32	141	16559	800.7
33	143	16815	838.5
34	145	17068	876.9
35	147	17317	915.9
36	149	17563	955.4
37	151	17805	995.5
38	153	18044	1036.1
39	155	18280	1077.3
40	157	18513	1119.0

54-INCH WHEEL

Head.	Revolutions per Minute.	Discharge, Cubic Feet Per Minute.	Horse Power.
5	51	7707	58.2
6	56	8449	76.5
7	60	9119	96.5
8	64	9748	117.8
9	68	10340	140.6
10	72	10899	164.7
11	75	11431	190.0
12	79	11939	216.5
13	82	12427	244.0
14	85	12896	272.8
15	88	13348	302.6
16	91	13786	333.3
17	94	14210	365.0
18	97	14622	397.7
19	99	15023	431.3
20	102	15413	465.8
21	105	15794	501.2
22	107	16166	537.4
23	109	16529	574.5
24	112	16885	612.3
25	114	17233	651.0
26	116	17574	690.4
27	119	17909	730.7
28	121	18237	771.6
29	123	18560	813.3
30	125	18878	855.7
31	127	19190	898.9
32	129	19497	942.7
33	131	19799	987.3
34	133	20097	1032.5
35	135	20390	1078.4
36	137	20679	1124.9
37	139	20965	1172.1
38	141	21246	1219.9
39	142	21524	1268.4
40	144	21798	1317.5

57-INCH WHEEL

Head.	Revolutions per Minute.	Discharge. Cubic feet per Minute.	Horse Power.
5	50	8646	65.3
6	55	9472	85.9
7	59	10231	108.2
8	63	10937	132.2
9	67	11601	157.8
10	70	12228	184.8
11	74	12825	213.2
12	77	13395	242.9
13	80	13942	273.9
14	83	14468	306.1
15	86	14976	339.4
16	89	15467	374.0
17	92	15943	409.6
18	94	16406	446.2
19	97	16855	483.9
20	100	17293	522.6
21	102	17720	562.3
22	104	18137	602.9
23	107	18545	644.5
24	109	18944	687.0
25	111	19334	730.4
26	113	19717	774.6
27	116	20093	819.7
28	118	20461	865.7
29	120	20824	912.5
30	122	21179	960.1
31	124	21530	1008.5
32	126	21874	1057.7
33	128	22213	1107.6
34	130	22547	1158.4
35	132	22876	1209.9
36	134	23201	1262.1
37	135	23521	1315.0
38	137	23837	1368.7
39	139	24148	1423.1
40	141	24456	1478.2

60-INCH WHEEL

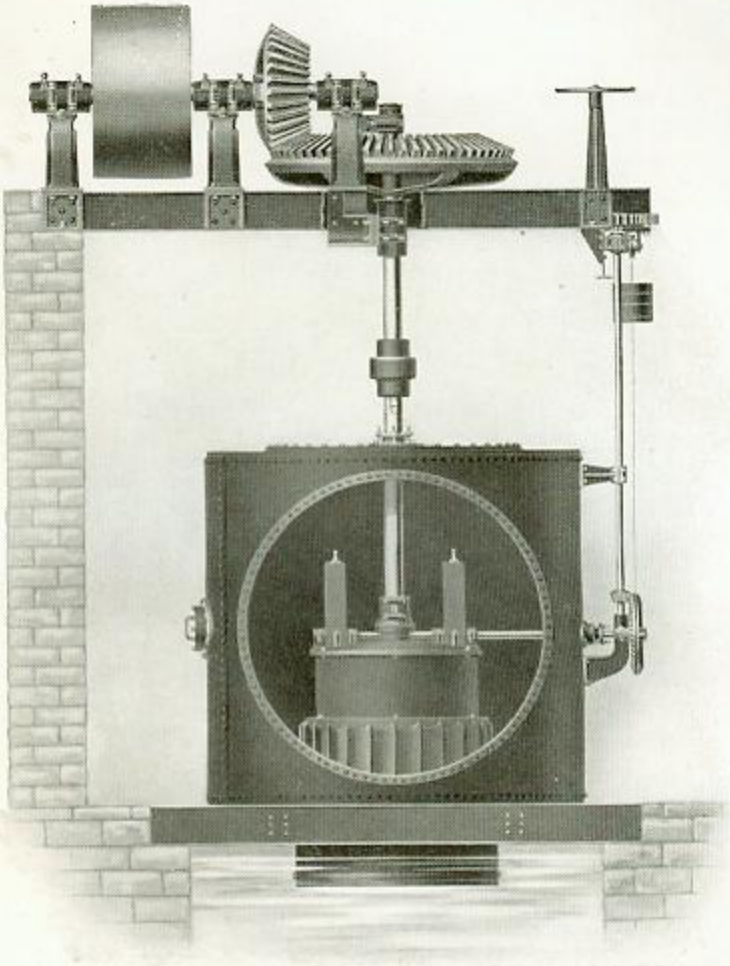
Head.	Revolutions per Minute.	Discharge. Cubic feet per Minute.	Horse Power.
4	42	9723	58.7
5	46	10870	82.2
6	50	11908	108.0
7	54	12862	136.0
8	58	13740	165.8
9	62	14584	198 3
10	65	15374	232.3
11	68	16124	267.9
12	71	16842	305.4
13	74	17529	344.2
14	77	18210	384 8
15	79	18829	426 8
16	82	19447	470.1
17	85	20044	514.9
18	87	20625	561.0
19	89	21192	608 4
20	92	21741	657.1
21	94	22279	706.9
22	96	22803	758.0
23	98	23316	810.3
24	101	23817	863.7
25	103	24308	918.2
26	105	24789	973 9
27	107	25262	1030 6
28	109	25725	1087.4
29	111	26181	1147.3
30	112	26629	1207.0
31	114	27068	1268.0
32	116	27501	1329 8
33	118	27928	1392.6
34	120	28348	1456.4
35	121	28762	1521.1
36	123	29170	1586.7
37	125	29573	1653.3
38	127	29970	1720.9
39	128	30361	1789.2
40	130	30748	1858.4

66-INCH WHEEL

Head.	Revolutions per Minute.	Discharge. Cubit feet per Minute.	Horse Power.
4	38	11765	71 1
5	42	13154	99 3
6	46	14409	130.6
7	49	15564	164.6
8	53	16669	201.1
9	56	17648	240 0
10	59	18602	281.0
11	62	19510	324 2
12	65	20378	369 4
13	67	21210	416.6
14	70	22011	465.6
15	72	22783	516.3
16	75	23530	568 9
17	77	24255	623.0
18	79	24957	678.8
19	81	25641	736.2
20	83	26308	795.1
21	86	26958	855.4
22	88	27592	917.2
23	89	28212	980,5
24	91	28819	1045.0
25	93	29413	1111.0
26	95	29996	1178.5
27	97	30567	1247.1
28	99	31128	1317.0
29	100	31678	1388.1
30	102	32221	1460.6
31	104	32753	1534.2
32	106	33277	1609 0
33	107	33793	1685.1
34	109	34297	1762.3
35	110	34802	1860.6
36	112	35296	1920 0
37	113	35782	2000 6
38	115	36264	2082.2
39	117	36738	2164.9
40	118	37206	2248.8

72-INCH WHEEL

Head.	Revolutions per Minute.	Discharge. Cubic feet per Minute.	Horse Power.
4	37	14796	89.3
5	41	16546	113.5
6	48	18119	164.2
7	49	19580	205.3
8	52	20931	252.9
9	56	22194	301.7
10	59	23412	354.6
11	61	24542	407.9
12	64	25627	464.6
13	67	26690	524.2
14	70	27687	586.4
15	72	28662	649 6
16	74	29514	716.0
17	77	30522	759.7
18	79	31408	854.2
19	81	32272	902.3
20	83	33114	1000.7
21	85	33911	1076.0
22	88	34709	1153.8
23	90	35484	1233.2
24	91	36259	1314.9
25	93	37012	1398.4
26	94	37743	1482.8
27	96	38452	1568.8
28	99	39161	1656.8
29	100	39847	1748.5
30	102	40534	1821.5
31	104	41199	1929 9
32	105	41863	2024.7
33	107	42528	2120.7
34	108	43170	2217.9
35	110	43790	2318.4
36	112	44410	2415 8
37	113	45030	2517.6
38	114	45629	2620.0
39	116	46227	2726 9
40	117	46802	2828.8



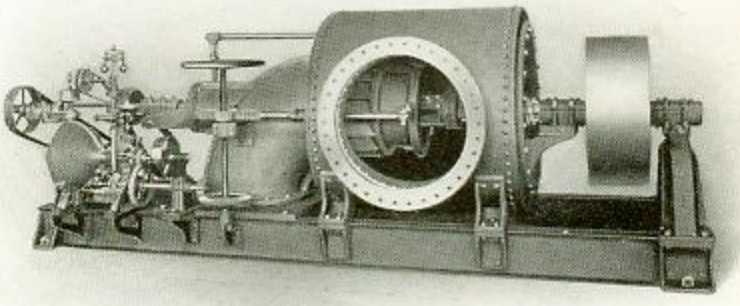
Engraving No. 404.

This represents an ideal setting for vertical shaft water wheels in outer steel cases.

This manner of supporting gears, pulley, horizontal and vertical shafts is of most substantial construction and modern in every respect.

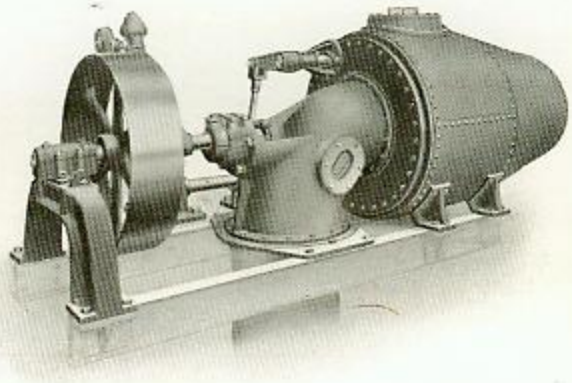
When desired and the location will permit, we can place all the gate gearing including racks and pinions on the outside of case, thereby removing all wearing parts from the water.

See dimensions of steel flumes on pages 36 and 37.



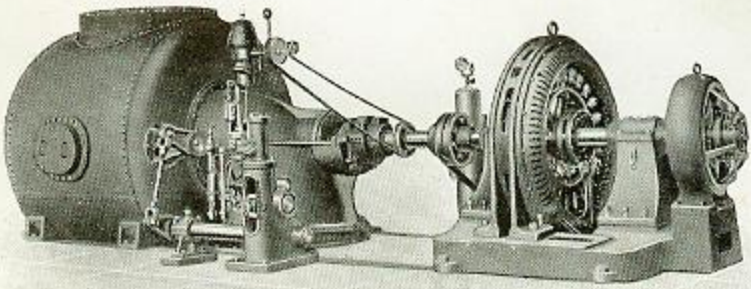
Engraving No. 406.

Single, horizontal shaft turbine in plate steel case with side supply, equipped with pulley for belt drive and fitted with a mechanical governor.



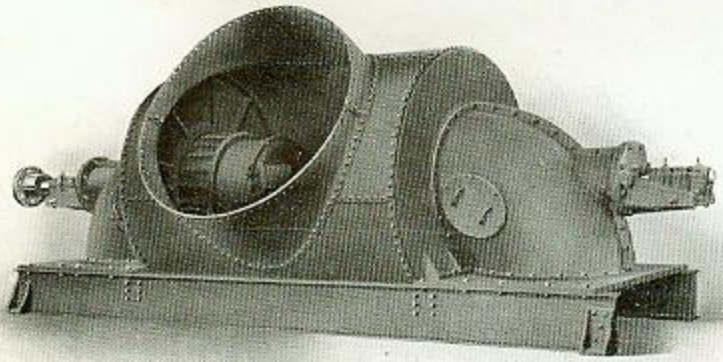
Engraving No. 407.

Single, horizontal shaft turbine enclosed in plate steel case with end supply, provided with pulley for belt drive and fitted with oil pressure type governor.



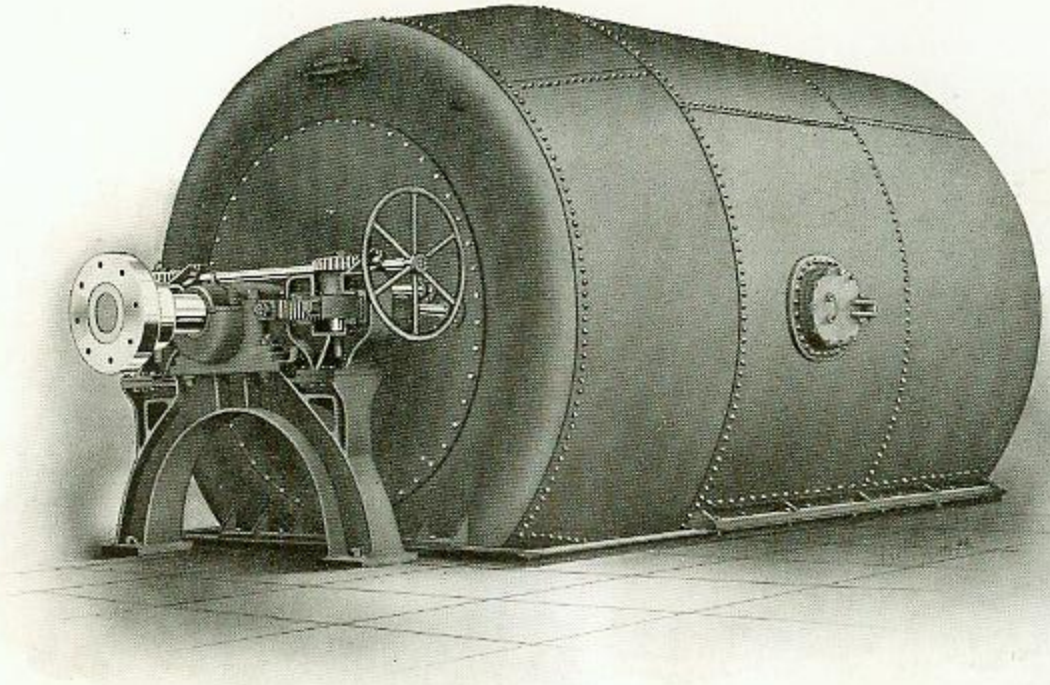
Engraving No. 408.

Single, horizontal shaft turbine in plate steel case with supply pipe connecton at the top. The turbine is direct connected to a generator and is equipped with oil pressure governor for speed regulation.



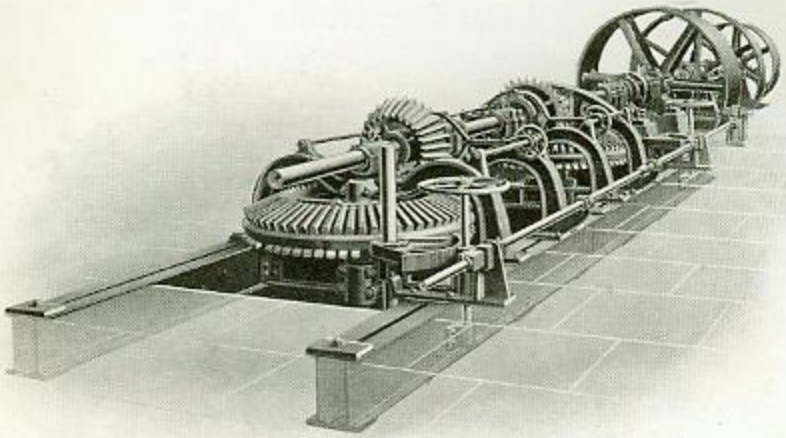
Engraving No. 409.

Pair of horizontal shaft turbines in plate steel case with double discharge, each wheel discharging through a cast iron elbow and draft tube. End of shaft is fitted with coupling for direct connection.



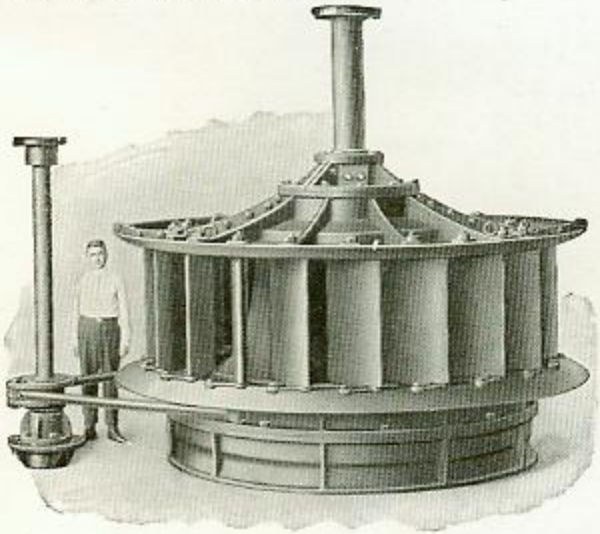
Engraving No. 410.

Pair of horizontal shaft, cylinder gate turbines enclosed in plate steel case, end supply. Turbine shaft fitted with coupling for direct connection. Cylinder gates are operated by draw rods, thereby placing all gearing on the outside of the case.



Engraving No. 411.

Represents the harness work for two large, vertical shaft turbines with extension shaft fitted with large driving pulleys. All bearings substantially mounted on heavy, cast iron bridge trees resting on double I-beam girders.

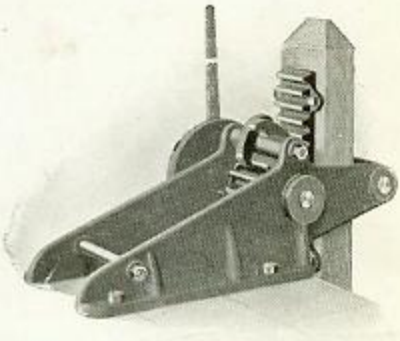


Engraving No. 412.

Illustrates large, vertical shaft, wicket gate type of wheel. These wheels are used under low and medium heads for direct connection to vertical shaft generators, a type of unit which is very popular at the present time.

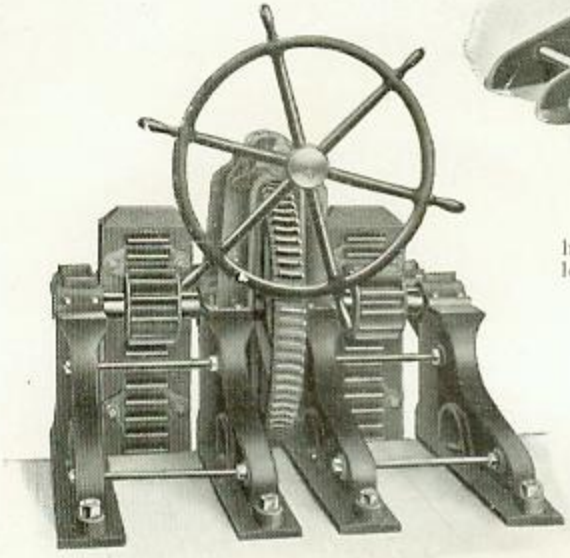
Head Gate Hoists

We have published special Bulletin No. 180 devoted exclusively to Head Gate Hoists and Valves, copy of which will be mailed on application.



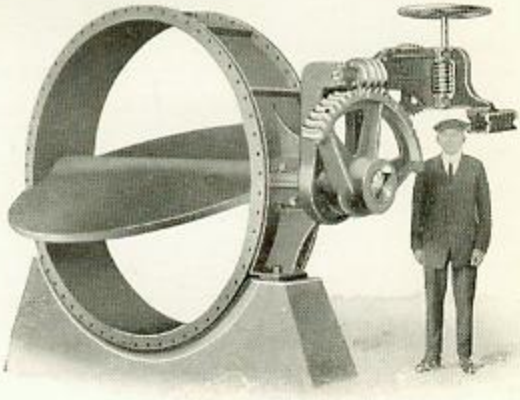
Engraving No. 413.

Single stem head gate hoist, winch wheel and lever type.



Engraving No. 414.

Double stem head gate hoist, worm geared type.



Engraving No. 415.

Large wicket gate valve with worm geared hand operating mechanism.

Measurement of Large Streams

On streams too large to measure by weir, the quantity of water is usually determined by "float measurement." In the use of this method it is important that the float be so made that it sinks well into the water. The measurements should be taken at a point where the velocity is not too great, and where the bed of the stream is uniform. If the stream be wide, the velocity in feet per minute should be taken near the shore and in the center; the average then is the velocity of the stream.

To ascertain the cubic feet of water, multiply the depth by the width, multiply this product by the velocity in feet per minute, and the result will be the number of cubic feet flowing per minute, from which deduct 20 per cent. for losses by friction, etc.

Measurement of Water Through Openings Under Pressure

Table giving the number of cubic feet of water discharged per minute, through an orifice one inch square, under any head from 3 to 62 inches.

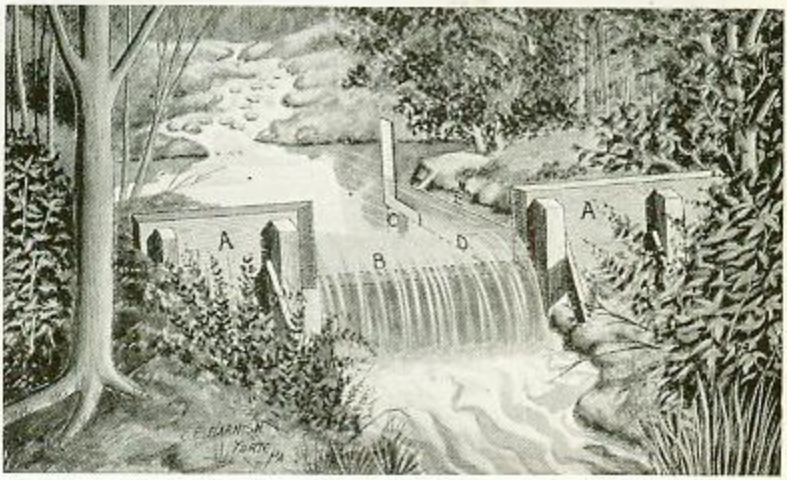
Head	Cubic Feet	Head	Cubic Feet	Head	Cubic Feet	Head	Cubic Feet	Head	Cubic Feet	Head	Cubic Feet
3	1.12	13	2.20	23	2.91	33	3.47	43	3.95	53	4.39
4	1.27	14	2.27	24	2.97	34	3.52	44	4.00	54	4.42
5	1.41	15	2.36	25	3.03	35	3.57	45	4.05	55	4.46
6	1.53	16	2.44	26	3.09	36	3.63	46	4.10	56	4.52
7	1.64	17	2.51	27	3.15	37	3.67	47	4.13	57	4.55
8	1.75	18	2.58	28	3.20	38	3.72	48	4.18	58	4.58
9	1.85	19	2.65	29	3.26	39	3.77	49	4.22	59	4.63
10	1.94	20	2.72	30	3.32	40	3.82	50	4.27	60	4.66
11	2.03	21	2.78	31	3.37	41	3.86	51	4.30	61	4.72
12	2.12	22	2.85	32	3.42	42	3.92	52	4.34	62	4.74

EXAMPLE SHOWING APPLICATION OF ABOVE TABLE

Suppose the opening to let the water on an overshot wheel be 36 inches long and the gate hoisted 2 inches; the head of water above opening 25 inches. Multiply the length, 36, by 2 (the height the gate is hoisted) and the result will be 72, the number of square inches in opening.

By referring to the above table, opposite 25-inch head, will be found 3.03; this multiplied by the 72 gives 218.16, the number of cubic feet of water passing through the opening per minute.

Rules for Measuring Water by Weirs



Engraving No. 416.

When a water power is to be developed, the first thing to do is to measure the head and quantity of water in the stream. The following rule is generally used to ascertain the amount of water in a small stream.

Engraving No. 416 shows a weir. A is a board extending across stream with notch B, over which the water flows, beveled on down stream side. The stake at which measurements are taken is located 4 to 8 feet from weir, on up stream side, top being on a level with top of notch in weir board as per line D. When the full flow of stream is passing over the weir the depth will be the distance from line D to line E (obtained by measuring on stake). The level of water surface on down stream side of weir should not be less than 8 inches below bottom of notch B in the weir board. The length of the notch B should never be less than three to four times the depth for very small streams, and longer for larger streams. See table for weir measurements on opposite page.

Table Showing the Quantity of Water Passing Over Weirs in Cubic Feet per Minute

Depth of water on weir in inch.	Cubic feet per minute passed for each foot of length of weir.	Depth of water on weir in inch.	Cubic feet per minute passed for each foot of length of weir.	Depth of water on weir in inch.	Cubic feet per minute passed for each foot of length of weir.	Depth of water on weir in inch.	Cubic feet per minute passed for each foot of length of weir.
1	4.85	4¼	50.20	8½	120.18	12½	214.32
1⅛	5.78	4⅜	52.18	8⅝	122.82	12¾	220.76
1¼	6.68	5	54.22	8¾	125.52	13	227.30
1⅜	7.80	5⅛	56.25	8⅞	128.14	13¼	233.92
1½	8.90	5¼	58.33	9	130.93	13½	240.54
1⅝	10.00	5⅜	60.42	9⅛	133.65	13¾	247.22
1¾	11.23	5½	62.55	9¼	136.43	14	254.03
1⅞	12.45	5⅝	64.68	9⅜	139.18	14¼	260.83
2	13.72	5¾	66.86	9½	141.99	14½	267.77
2⅛	15.02	5⅞	68.98	9⅝	144.80	14¾	274.70
2¼	16.36	6	71.27	9¾	147.64	15	281.72
2⅜	17.75	6⅛	73.45	9⅞	150.47	15¼	288.82
2½	19.17	6¼	75.77	10	153.35	15½	295.93
2⅝	20.63	6⅜	78.04	10⅛	156.20	15¾	303.10
2¾	22.11	6½	80.36	10¼	159.14	16	310.36
2⅞	23.63	6⅝	82.63	10⅜	162.07	16¼	317.69
3	25.20	6¾	85.04	10½	164.99	16½	325.03
3⅛	26.78	6⅞	87.43	10⅝	167.89	16¾	332.42
3¼	28.43	7	89.82	10¾	169.92	17	339.91
3⅜	30.06	7⅛	92.16	10⅞	173.90	17¼	347.45
3½	31.75	7¼	94.67	11	176.92	17½	355.02
3⅝	33.45	7⅜	97.11	11⅛	179.94	17¾	362.77
3¾	35.22	7½	99.50	11¼	182.99	18	370.34
3⅞	36.98	7⅝	102.10	11⅜	186.03	18¼	378.12
4	38.80	7¾	104.63	11½	189.13	18½	385.87
4⅛	40.63	7⅞	107.13	11⅝	192.20	18¾	393.66
4¼	42.49	8	109.74	11¾	195.32	19	401.63
4⅜	44.39	8⅛	112.31	11⅞	198.47	19¼	409.58
4½	46.29	8¼	114.91	12	201.59	19½	417.48
4⅝	48.22	8⅜	117.51	12¼	207.94	19¾	425.68

For explanation of above table and construction of Weirs see opposite page

Velocity of Water

Table giving velocity of water in feet per second, and the cubic feet of water per minute, to develop one horse-power at 80 per cent. efficiency under heads from 1 to 297 feet.

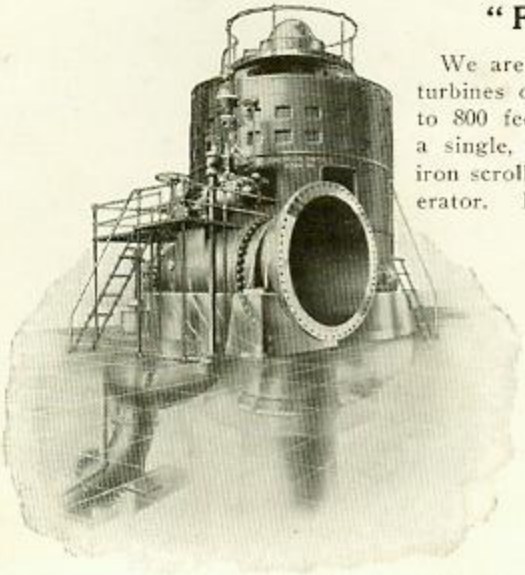
Head	Velocity	Cubic Feet	Head	Velocity	Cubic Feet	Head	Velocity	Cubic Feet
1	8.02	661.765	49	56.14	13.505	97	79.00	6.822
2	11.34	330.883	50	56.71	13.236	98	79.40	6.753
3	13.89	220.589	51	57.27	12.976	99	79.81	6.685
4	16.04	165.441	52	57.84	12.726	100	80.22	6.618
5	17.92	132.353	53	58.39	12.486	101	80.61	6.552
6	19.65	110.294	54	58.93	12.255	102	81.01	6.487
7	21.22	94.538	55	59.48	12.032	103	81.40	6.425
8	22.68	82.720	56	60.01	11.817	104	81.80	6.363
9	24.06	73.529	57	60.56	11.610	105	82.19	6.303
10	25.36	66.177	58	61.08	11.410	106	82.58	6.243
11	26.60	60.160	59	61.61	11.216	107	82.97	6.185
12	27.78	55.147	60	62.12	11.029	108	83.35	6.127
13	28.92	50.905	61	62.71	10.849	109	83.74	6.071
14	30.01	47.269	62	63.15	10.674	110	84.12	6.016
15	31.06	44.118	63	63.66	10.504	111	84.50	5.962
16	32.08	41.360	64	64.16	10.340	112	84.88	5.909
17	33.07	38.927	65	64.66	10.181	113	85.25	5.857
18	34.03	36.765	66	65.16	10.027	114	85.63	5.805
19	34.96	34.830	67	65.65	9.877	115	86.00	5.755
20	35.87	33.088	68	66.14	9.732	116	86.38	5.705
21	36.75	31.513	69	66.62	9.591	117	86.75	5.656
22	37.61	30.080	70	67.11	9.454	118	87.12	5.608
23	38.46	28.772	71	67.58	9.321	119	87.49	5.561
24	39.29	27.574	72	68.06	9.191	120	87.86	5.514
25	40.10	26.471	73	68.53	9.065	121	88.22	5.469
26	40.89	25.453	74	69.00	8.943	122	88.58	5.424
27	41.67	24.510	75	69.46	8.822	123	88.94	5.380
28	42.44	23.634	76	69.92	8.707	124	89.30	5.337
29	43.19	22.819	77	70.38	8.594	125	89.66	5.294
30	43.93	22.059	78	70.84	8.484	126	90.02	5.252
31	44.65	21.347	79	71.29	8.377	127	90.38	5.211
32	45.37	20.680	80	71.74	8.272	128	90.74	5.170
33	46.07	20.053	81	72.19	8.170	129	91.09	5.130
34	46.77	19.464	82	72.63	8.070	130	91.44	5.090
35	47.45	18.908	83	73.07	7.973	131	91.79	5.051
36	48.12	18.382	84	73.51	7.878	132	92.14	5.013
37	48.78	17.886	85	73.95	7.785	133	92.49	4.976
38	49.44	17.415	86	74.38	7.695	134	92.84	4.939
39	50.09	16.968	87	74.81	7.606	135	93.19	4.902
40	50.72	16.544	88	75.24	7.520	136	93.54	4.866
41	51.35	16.141	89	75.67	7.436	137	93.88	4.830
42	51.98	15.756	90	76.09	7.353	138	94.22	4.795
43	52.59	15.390	91	76.51	7.272	139	94.56	4.761
44	53.20	15.040	92	76.93	7.193	140	94.90	4.727
45	53.80	14.706	93	77.35	7.116	141	95.23	4.693
46	54.40	14.368	94	77.76	7.040	142	95.57	4.660
47	54.99	14.080	95	78.18	6.966	143	95.90	4.627
48	55.57	13.787	96	78.59	6.893	144	96.24	4.595

VELOCITY OF WATER—Continued

Head	Velocity	Cubic Feet	Head	Velocity	Cubic Feet	Head	Velocity	Cubic Feet
145	96.57	4.563	196	112.28	3.376	247	126.05	2.679
146	96.90	4.532	197	112.57	3.359	248	126.30	2.668
147	97.23	4.501	198	112.85	3.342	249	126.56	2.657
148	97.56	4.471	199	113.14	3.325	250	126.81	2.647
149	97.89	4.441	200	113.42	3.309	251	127.07	2.636
150	98.22	4.411	201	113.70	3.292	252	127.32	2.626
151	98.53	4.382	202	113.98	3.276	253	127.57	2.616
152	98.88	4.353	203	114.26	3.259	254	127.82	2.605
153	99.20	4.325	204	114.54	3.243	255	128.07	2.595
154	99.53	4.297	205	114.82	3.227	256	128.32	2.585
155	99.85	4.269	206	115.11	3.212	257	128.57	2.575
156	100.18	4.242	207	115.39	3.196	258	128.82	2.565
157	100.50	4.215	208	115.68	3.181	259	129.07	2.555
158	100.81	4.188	209	115.95	3.166	260	129.32	2.545
159	101.13	4.162	210	116.23	3.151	261	129.57	2.535
160	101.44	4.136	211	116.50	3.136	262	129.82	2.525
161	101.75	4.110	212	116.78	3.121	263	130.07	2.515
162	102.07	4.085	213	117.05	3.106	264	130.32	2.506
163	102.38	4.060	214	117.32	3.092	265	130.57	2.497
164	102.70	4.035	215	117.59	3.077	266	130.81	2.488
165	103.01	4.010	216	117.86	3.063	267	131.06	2.478
166	103.33	3.986	217	118.13	3.049	268	131.30	2.469
167	103.64	3.962	218	118.41	3.035	269	131.55	2.460
168	103.96	3.939	219	118.68	3.021	270	131.79	2.451
169	104.27	3.915	220	118.96	3.008	271	132.04	2.442
170	104.57	3.892	221	119.22	2.994	272	132.28	2.433
171	104.88	3.869	222	119.49	2.981	273	132.52	2.424
172	105.18	3.847	223	119.75	2.967	274	132.76	2.415
173	105.49	3.825	224	120.02	2.954	275	133.00	2.406
174	105.79	3.803	225	120.30	2.941	276	133.24	2.397
175	106.10	3.781	226	120.57	2.928	277	133.49	2.388
176	106.40	3.760	227	120.85	2.915	278	133.73	2.380
177	106.70	3.739	228	121.12	2.902	279	133.98	2.371
178	107.00	3.718	229	121.38	2.889	280	134.22	2.363
179	107.30	3.697	230	121.64	2.877	281	134.46	2.354
180	107.60	3.676	231	121.90	2.864	282	134.70	2.346
181	107.90	3.656	232	122.16	2.852	283	134.94	2.338
182	108.20	3.636	233	122.42	2.840	284	135.16	2.330
183	108.50	3.616	234	122.69	2.828	285	135.40	2.321
184	108.80	3.596	235	122.95	2.816	286	135.64	2.313
185	109.09	3.577	236	123.22	2.804	287	135.88	2.305
186	109.39	3.558	237	123.47	2.792	288	136.12	2.297
187	109.68	3.539	238	123.73	2.780	289	136.36	2.289
188	109.98	3.520	239	123.98	2.768	290	136.60	2.281
189	110.27	3.501	240	124.24	2.757	291	136.84	2.273
190	110.56	3.483	241	124.50	2.745	292	137.06	2.266
191	110.85	3.464	242	124.76	2.734	293	137.29	2.258
192	111.14	3.446	243	125.02	2.723	294	137.53	2.250
193	111.42	3.429	244	125.28	2.712	295	137.76	2.242
194	111.71	3.411	245	125.54	2.701	296	138.00	2.235
195	111.99	3.393	246	125.79	2.690	297	138.23	2.227

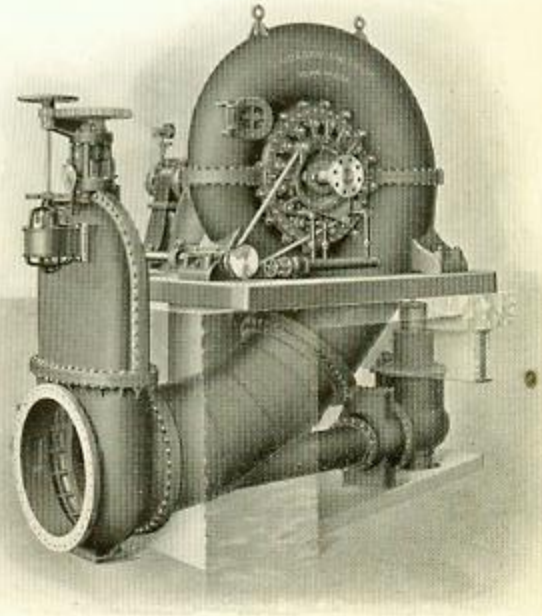
"Francis" Turbines

We are prepared to design and build turbines of special design for heads up to 800 feet. Engraving 417 represents a single, vertical shaft turbine in cast iron scroll case, direct connected to generator. Engraving 418 shows single, horizontal shaft, scroll case unit.



Engraving No. 417.

We also build all accessories required in connection with water power development, such as head gate equipment, trash rack, riveted steel pipe, gearing, shafting, bearings, pulleys, governors, pressure regulators, etc.



Engraving No. 418.

18-INCH WHEEL

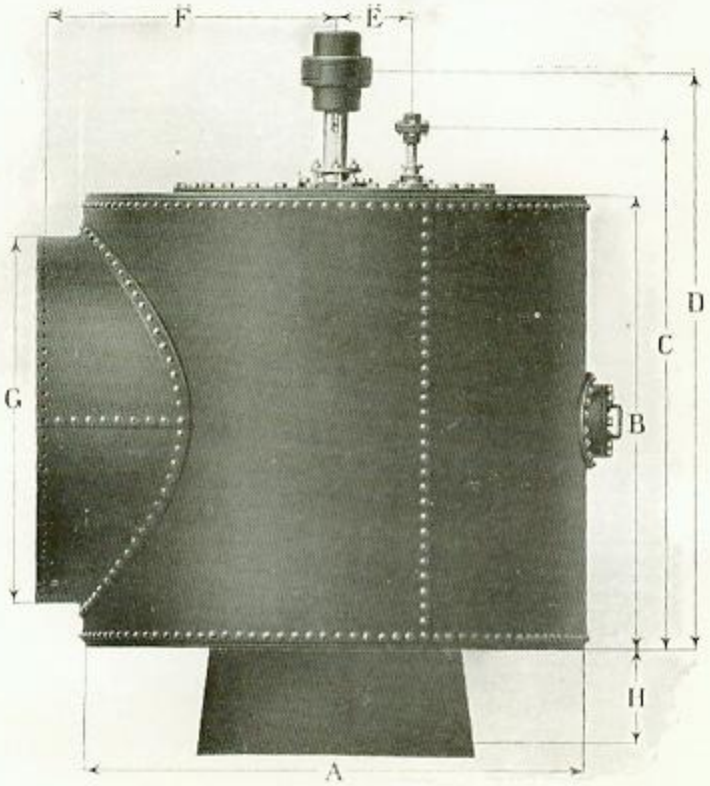
Head.	Revolutions per Minute.	Discharge, Cubic feet per Minute.	Horse Power.
5	144	828	6.3
6	158	908	8.2
7	170	980	10.4
8	182	1048	12.7
9	193	1111	15.1
10	203	1172	17.7
11	213	1229	20.4
12	223	1283	23.3
13	232	1336	26.2
14	241	1386	29.3
15	249	1435	32.5
16	257	1482	35.8
17	265	1528	39.2
18	273	1572	42.8
19	280	1615	46.4
20	288	1657	50.1
21	295	1698	53.9
22	302	1738	57.8
23	309	1777	61.8
24	315	1815	65.8
25	322	1852	70.0
26	328	1889	74.2
27	334	1925	78.5
28	340	1960	82.9
29	346	1995	87.4
30	352	2029	92.0
31	358	2063	96.6
32	364	2096	101.3
33	370	2128	106.1
34	375	2160	111.0
35	381	2192	115.9
36	386	2223	120.9
37	391	2254	126.0
38	397	2284	131.1
39	402	2314	136.4
40	407	2343	141.6

21-INCH WHEEL

Head	Revolutions per Minute.	Discharge. Cubic feet per Minute.	Horse Power.
5	137	1172	8.9
6	150	1283	11.6
7	162	1386	14.7
8	173	1482	17.9
9	184	1572	21.4
10	194	1657	25.0
11	203	1738	28.9
12	212	1815	32.9
13	221	1889	37.1
14	229	1960	41.5
15	237	2029	46.0
16	245	2096	50.7
17	253	2160	55.5
18	260	2223	60.5
19	267	2284	65.6
20	274	2343	70.8
21	281	2401	76.2
22	287	2457	81.7
23	294	2513	87.3
24	300	2567	93.1
25	306	2620	99.0
26	312	2672	105.0
27	318	2722	111.1
28	324	2772	117.3
29	330	2821	123.6
30	336	2870	130.1
31	341	2917	136.6
32	347	2964	143.3
33	352	3010	150.1
34	357	3055	157.0
35	362	3100	163.9
36	368	3144	171.0
37	373	3187	178.2
38	378	3230	185.5
39	383	3272	192.8
40	387	3314	200.3

42-INCH WHEEL

Head.	Revolutions per Minute.	Discharge. Cubic feet per Minute.	Horse Power.
5	67	4786	36.2
6	74	5242	47.5
7	80	5662	59.9
8	85	6053	73.2
9	90	6421	87.3
10	95	6768	102.3
11	100	7098	118.0
12	104	7414	134.4
13	108	7717	151.6
14	112	8008	169.4
15	116	8289	187.9
16	120	8561	207.0
17	124	8824	226.7
18	128	9080	247.0
19	131	9329	267.8
20	134	9571	289.3
21	138	9808	311.2
22	141	10038	333.7
23	144	10264	356.7
24	147	10485	380.2
25	150	10701	404.2
26	153	10913	428.7
27	156	11121	453.7
28	159	11325	479.1
29	162	11525	505.0
30	165	11722	531.4
31	167	11916	558.2
32	170	12107	585.4
33	173	12294	613.1
34	175	12479	641.1
35	178	12661	669.6
36	180	12841	698.5
37	183	13018	727.8
38	185	13193	757.5
39	188	13365	787.6
40	190	13536	818.1



Engraving No. 405.

The price of steel flumes usually exceeds the cost of those constructed from wood, but for many locations they are more desirable on account of their durability and freedom from leakage.

Each flume has a heavy cast iron top and bottom. The top is provided with a lid of sufficient size to admit the wheel and contains packing boxes for wheel and gate shafts.

A man door is conveniently located on the side of the flume affording easy access to the water wheel. See dimensions of flumes on page 37.

DIMENSIONS OF STEEL FLUMES IN INCHES

Lettered columns correspond with letters in Engraving No. 405

Diameter of Wheel	A	B	C	D	E	F	G	H
9	36	36		57½	Dimensions given upon application	24	24	6¼
12	42	42		64½		27	30	7⅞
15	48	48		70½		30	36	9⅝
18	54	54	69½	76½		33	42	10½
21	60	60	75½	83		38	48	12⅜
24	72	70	85½	93		44	54	13¾
27	84	76	91½	99		50	60	15½
30	93	82	97½	106¾		53	66	16⅞
33	96	90	108½	119		56	72	18⅜
36	102	96	114½	125		59	78	21⅜
39	108	102	120½	128½		62	84	22¾
42	114	108	126½	137½		65	90	25¼
45	120	112	130½	142½		68	94	26⅝
48	126	114	132½	144½		71	96	28⅛
51	132	118	139½	152½		74	100	29¾
54	144	122	144	156½		80	104	21⅝
57	156	126	148	161¾		86	108	33⅛
60	168	132	154	167¾		92	114	35
66	180	138	160	173¾		98	120	41
72	200	162	184	197¾		108	144	46¾